4.3. TRAFFIC PARAMETERS

4.3.1. Local Call Attempts

Definition : The number of yearly local call attempts, as reported to the FCC.

Default Value: Taken from ARMIS reports for the LEC being studied.

Support: 1996 ARMIS report 43-08. For non-Tier I LECs, the default value is the average per line local call attempt value for all ICOs reporting to ARMIS.

4.3.2. Call Completion Fraction

Definition: The percentage of call attempts that result in a completed call. By this definition, calls that result in a busy signal, no answer, or network blockage are all considered incomplete.

Default Value:

Call Completion Fraction
0.7

Support: Bell Communications Research, *LATA Switching Systems Generic Requirements*, Section 17: Traffic Capacity and Environment, TR-TSY-000517, Issue 3, March 1989. This number is a composite of the results shown in table 17.6-B.

4.3.3. IntraLATA Calls Completed

Definition : The number of yearly intraLATA completed call attempts, as reported to the FCC.

Default Value: Taken from 1996 ARMIS reports for the LEC being studied.

Support: 1996 ARMIS report 43-08. For non-Tier I LECs, the default value is the average per line IntraLATA calls completed value for all ICOs reporting to ARMIS.

4.3.4. InterLATA Intrastate Calls Completed

Definition : The number of yearly interLATA intrastate completed call attempts, as reported to the FCC.

Default Value: Taken from 1996 ARMIS reports for the LEC being studied.

Support: 1996 ARMIS report 43-08. For non-Tier I LECs, the default value is the average per line interLATA intrastate calls completed value for all ICOs reporting to ARMIS.

4.3.5. InterLATA Interstate Calls Completed

Definition : The number of yearly interLATA interstate completed call attempts, as reported to the FCC.

Default Value: Taken from 1996 ARMIS reports for the LEC being studied.

Support: 1996 ARMIS report 43-08. For non-Tier I LECs, the default value is the average per line interLATA interstate calls completed value for all ICOs reporting to ARMIS.

4.3.6. Local DEMs, Thousands

Definition : The number of yearly local Dial Equipment Minutes (DEMs), as reported to the FCC.

Default Value: Taken from FCC reports for the LEC being studied.

Support: See FCC Monitoring Report, Docket No. 87-339, May 1995, Table 4.15.

4.3.7. Intrastate DEMs, Thousands

Definition: The number of yearly intrastate DEMs, as reported to the FCC.

Default Value: Taken from FCC reports for the LEC being studied.

Support: See FCC Monitoring Report, Docket No. 87-339, May 1995, Table 4.16.

4.3.8. Interstate DEMs, Thousands

Definition: The number of yearly interstate DEMs, as reported to the FCC.

Default Value: Taken from FCC reports for the LEC being studied.

Support: See FCC Monitoring Report, Docket No. 87-339, May 1995, Table 4.17.

4.3.9. Local Business/Residential DEMs Ratio

Definition: The ratio of local Business DEMs per line to local Residential DEMs per line

Default Value:

Local Bus / Res DEMs Ratio
1.1

Support: This is a HAI estimate, based on consultations with AT&T and MCI subject matter experts.

4.3.10. Intrastate Business/Residential DEMs

Definition: The ratio of intrastate Business DEMs per line to intrastate Residential DEMs per line

Default Value:

Intrastate Bus / Res DEMs Ratio
2

Support: This is a HAI estimate, based on consultations with AT&T and MCI subject matter experts.

4.3.11. Interstate Business/Residential DEMs

Definition: The ratio of interstate Business DEMs per line to interstate Residential DEMs per line

Default Value:

Interstate Bus / Res DEMs Ratio
3

Support: This is a HAI estimate, based on consultations with AT&T and MCI subject matter experts.

4.3.12. Busy Hour Fraction of Daily Usage

Definition: The percentage of daily usage that occurs during the busy hour.

Default Value:

Busy Hour Fraction of Daily Usage
0.10

Support: AT&T Capacity Cost Study.[30]

4.3.13. Annual to Daily Usage Reduction Factor

Definition: The effective number of business days in a year, used to concentrate annual usage into a fewer number of days as a step in determining busy hour usage.

Default Value:

Annual to Daily Usage Reduction Factor
270

Support: The AT&T Capacity Cost Study uses an annual to daily usage reduction factor of 264 days.[31]

[30] Blake, V.A., Flynn, P.V., Jennings, F.B., AT&T Bell Laboratories, *"A Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth"*, June 20, 1990, p.10. Filed in CC Docket No. 90-132.

[31] Blake, V.A., Flynn, P.V., Jennings, F.B., AT&T Bell Laboratories, *"A Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth"*, June 20, 1990, p.10. Filed in CC Docket No. 90-132.

4.3.14. Holding Time Multipliers, Residential/Business

Definition: The potential modification to the average call "holding time" (i.e., duration) to reflect Internet use or other causes, expressed as a multiplier of the holding time associated with ordinary residential or business telephone calls.

Default Values:

Holding time multipliers	
Residential	Business
1.0	1.0

Support: The purpose of this parameter is to allow users to study the impact of increasing the offered load on the network. The default value of 1 means the load is that estimated from DEMs.

4.3.15. Call Attempts, Busy Hour (BHCA), Residential/Business

Definition: The number of call attempts originated per residential and business subscriber during the busy hour.

Default Values:

Busy Hour Call Attempts	
Residential	Business
1.3	3.5

Support: Bell Communications Research, *LATA Switching Systems Generic Requirements*, Section 17: Traffic Capacity and Environment, TR-TSY-000517, Issue 3, March 1989. This number is a composite of the results shown in table 17.6 C-G.

4.4. INTEROFFICE INVESTMENT

4.4.1. Transmission Terminal Investment

Definition: The investment in 1) the fully-equipped add-drop multiplexer (ADM) that extracts/inserts signals into OC-48 or OC-3 fiber rings, and are needed in each wire center to connect the wire center to the interoffice fiber ring; and 2) the fully-equipped OC-3/DS-1 terminal multiplexers required to interface to the OC-48 ADM and to provide point to point circuits between on-ring wire centers and end offices not connected directly to a fiber ring. The "Investment per 7 DS-1" figure is the amount by which the investment in OC-3s is reduced for each unit of 7 DS-1s below full capacity of the OC-3. See the figure in Appendix A.

Default Values:

Transmission Terminal Investment			
OC-48 ADM, Installed		OC-3/DS-1 ADM/Terminal Multiplexer, Installed	Investment per 7 DS-1s
48 DS-3s	12 DS-3s	84 DS-1s	7 DS-1s
$50,000	$40,000	$26,000	$500

Support: Industry experience and expertise of HAI, supplemented by consultations with telecommunications equipment suppliers.

4.4.2. Number of Fibers

Definition: The assumed fiber cross-section, or number of fibers in a cable, in the interoffice fiber ring and point to point network.

Default Value:

Number of Fibers
24

Support: The default value is consistent with common practices within the telecommunications industry and reflects the engineering judgment of Hatfield Model developers.

4.4.3. Pigtail Investment

Definition: The cost of the short fiber connectors that attach the interoffice ring fibers to the wire center transmission equipment via a patch panel.

Default Value:

Pigtail Investment
$60 each

Support: A public source estimates the cost of pigtails at $75.00 per fiber. See, Reed, David P., *Residential Fiber Optic Networks and Engineering and Economic Analysis*, Artech House, Inc., 1992, p.93. The lower amount reflects an HAI estimate of price trends since that figure was published.

4.4.4 Optical Distribution Panel

Definition: The cost of the physical fiber patch panel used to connect 24 fibers to the transmission equipment.

Default Value:

Optical Distribution Panel
$1,000

Support: The cost for an installed fiber optic patch panel, including splicing of the fibers to pigtails, was estimated by a team of experienced outside plant experts who have contracted for such installations. A fiber optic patch panel contains no electronic or moving parts, but allows for the physical cross connection of fiber pigtails.

4.4.5. EF&I, per Hour

Definition: The per-hour cost for the "engineered, furnished, and installed" activities for equipment in each wire center associated with the interoffice fiber ring, such as the "pigtails" and patch panels to which the transmission equipment is connected.

Default Value:

EF&I
$55 per hour

Support: This is a fully loaded labor rate used for the most sophisticated technicians. It includes basic wages and benefits, Social Security, Relief & Pensions, management supervision, overtime, exempt material and motor vehicle loadings. A team of experienced outside plant experts estimated this value.

4.4.6. EF&I, Units

Definition: The number of hours required to install the equipment associated with the interoffice transmission system (see EF&I, per hour, above) in a wire center.

Default Value:

EF&I, units
32 hours

Support: This amount of labor was estimated by a team of experienced engineering experts. It includes the labor hours to install and test the transport equipment involved in interoffice facilities.

4.4.7. Regenerator Investment, Installed

Definition: The installed cost of an OC-48 optical regenerator.

Default Value:

Regenerator Investment, Installed
$15,000

Support: This approximation was obtained from a representative of a major fiber optic multiplexer manufacturer at Supercom '96, in June 1996 in Dallas, Texas.

4.4.8. Regenerator Spacing, Miles

Definition: The distance between digital signal regenerators in the interoffice fiber optics transmission system.

Default Value:

Regenerator Spacing
40 miles

Support: Based on field experience of maximum distance before fiber regeneration is necessary. This number is conservatively low compared to Fujitsu product literature, which indicates a maximum regenerator spacing of 110km, or approximately 69 miles[32] (with post- and pre-amp).

4.4.9. Channel Bank Investment, per 24 Lines

Definition: The investment in voice grade to DS-1 multiplexers in wire centers required for some special access circuits.

Default Value:

Channel Bank Investment, per 24 lines
$5,000

Support: Industry experience and expertise of HAI, supplemented by consultations with telecommunications equipment suppliers.

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[32] Futjitsu Network Communications, Inc. product sheet for Flash™-192 multiplexer, *"Typical Optical Span Lengths SMF Fiber {Single Mode Fiber} 110 km (with post- and pre-amp)."*

4.4.10. Fraction of SA Lines Requiring Multiplexing

Definition: The percentage of special access circuits that require voice grade to DS-1 multiplexing in the wire center in order to be carried on the interoffice transmission system. This parameter is for use in conjunction with a study of the cost of special access circuits.

Default Value:

Fraction of SA Lines Requiring Multiplexing
0.0

Support: This value is based on HAI engineering judgment. The default value of zero is appropriate for the existing set of UNEs, which do not include a special access UNE.

4.4.11. Digital Cross Connect System, Installed, per DS-3

Definition: The investment required for a digital cross connect system that interfaces DS-1 signals between switches and OC-3 multiplexers, expressed on a per DS-3 (672 DS-0) basis.

Default Value:

Digital Cross Connect System, Installed, per DS-3
$30,000

Support: Industry experience and expertise of HAI, supplemented by consultations with telecommunications equipment suppliers.

4.4.12. Transmission Terminal Fill (DS-0 level)

Definition: The fraction of maximum DS-0 circuit capacity that can actually be utilized in ADMs, DS-1 to OC-3 multiplexers, and channel banks.

Default Value:

Transmission Terminal Fill (DS-0 level)
0.90

Support: Based on outside plant subject matter expert judgment.

4.4.13. Interoffice Fiber Cable Investment per Foot, Installed

Definition: The installed cost per foot of interoffice fiber cable, assuming a 24-fiber cable.

Default Value:

Interoffice Fiber Cable Investment, Installed, per foot
$3.50

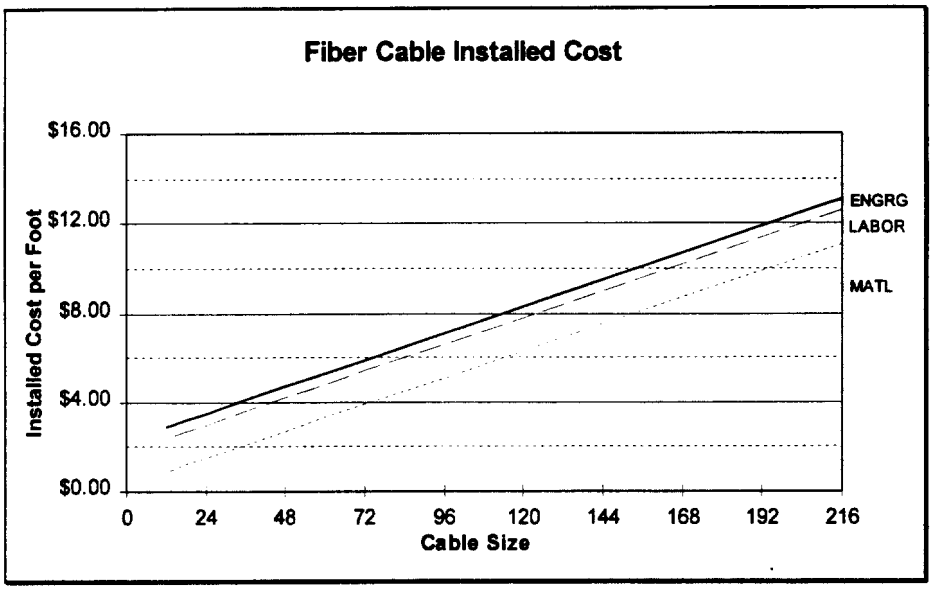
Support: ***{NOTE: The discussion in Section 3.4.2. [Fiber Feeder] is reproduced here for ease of use.}***

Outside plant planning engineers commonly assume that the cost of cable material can be represented as an a + bx straight line graph. In fact, Bellcore Planning tools, EFRAP I, EFRAP II, and LEIS:PLAN have the engineer develop such an a + bx equation to represent the cost of cable. As technology, manufacturing methods, and competition have advanced, the price of cable has been reduced. While in the past, the cost of fiber cable was typically ($.50 + $.10 per fiber) per foot, current costs are typically ($.30 + $.05 per fiber) per foot.

Splicing Engineering and Direct Labor are included in the cost of the Remote Terminal Installations, and the Central Office Installations, since field splicing is unnecessary with fiber cable pulls as long as 35,000 feet between splices.

Placing Engineering and Direct Labor are estimated at $2.00 per foot, consisting of $0.50 in engineering per foot, plus $1.50 direct labor per foot. These estimates were provided by a team of Outside Plant Engineering and Construction experts.

The following chart represents the default values used in the model.



4.4.14. Number of Strands per ADM

Definition: The number of interoffice fiber strands connected to the ADM in each wire center. At least four per ADM are required around the ring.

Default Value:

Number of Strands per ADM
4

Support: This is the standard number of strands required by an ADM. It provides for redundant transmission in both directions around the interoffice fiber ring.

4.4.15. Interoffice Structure Percentages

Definition: The relative amounts of different structure types supporting interoffice transmission facilities. Aerial cable is attached to telephone poles or buildings, buried cable is laid directly in the earth, and underground cable runs through underground conduit. Aerial and buried percentages are entered by the user; the underground fraction is then computed.

Default Values:

Structure Percentages		
Aerial	Buried	Underground
20%	60%	20%

Support: These are average figures that reflect the judgment of a team of outside plant experts regarding the appropriate mix of density zones applicable to interoffice transmission facilities.

4.4.16. Transport Placement

Definition: The cost of fiber cable structures used in the interoffice transmission system.

Default Values:

Transport Placement, per foot	
Buried	Conduit
$1.77	$16.40

Support: Structures closer to the central office are normally shared with feeder cable. Additional structures at the end of feeder routes may be required to complete an interoffice transport path. Since distances farther from the central office normally involve lower density zones, average structure costs appropriate for lower density zones are reflected in the default values. A default value for Buried representing the lower density zones is used, while a conservatively higher value is used for Conduit, representing the default value expected in a 850-2,550 line per square mile density zone.

4.4.17. Buried Sheath Addition

Definition: The cost of dual sheathing for additional mechanical protection of fiber interoffice transport cable.

Default Value:

Buried Sheath Addition
$0.20 per foot

Support: ***{NOTE: The discussion in Section 3.2.3. [Fiber Feeder] is reproduced here for ease of use.}***

Incremental cost for mechanical sheath protection on fiber optic cable is a constant per foot, rather than the ratio factor used for copper cable, because fiber sheath is approximately ½ inch in diameter, regardless of the number of fiber strands contained in the sheath. The incremental per foot cost was estimated by a team of experienced outside plant experts who have purchased millions of feet of fiber optic cable.

4.4.18. Interoffice Conduit, Cost and Number of Tubes

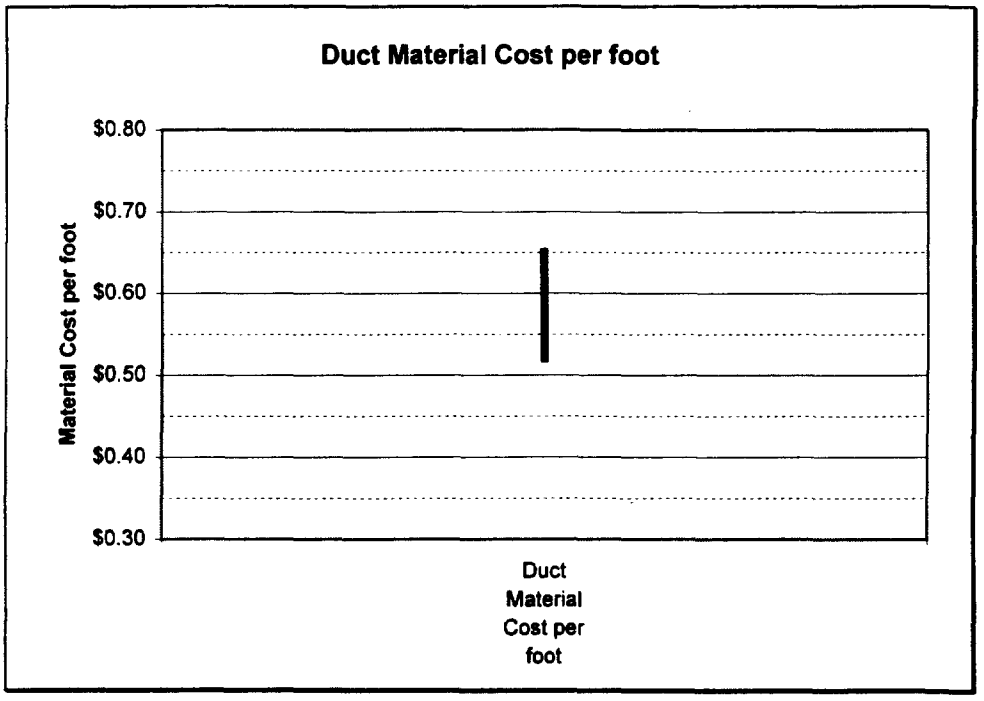
Definition: The cost per foot for interoffice fiber cable conduit, and the number of spare tubes (conduit) placed per route.

Default Values:

Interoffice Conduit, Cost and Number of Tubes	
Cost	**Spare Tubes per Route**
$0.60 per foot	1

Support: ***{NOTE: The discussions in Sections 2.4.3. and 2.4.4. [Distribution] are reproduced here for ease of use.}***

Conduit Cost per foot:
Several suppliers were contacted for material prices. Results are shown below.



The labor to place conduit in trenches is included in the cost of the trench, not in the conduit cost.

Under the Model's assumptions, a relatively few copper cables serving short distances (e.g., less than 9,000 ft. feeder cable length), and one or more fiber cables to serve longer distances, will be needed. Since the number of cables in each of the four feeder routes is relatively small, the predominant cost is that of the trench, plus the material cost of a few additional 4" PVC conduit pipes. No additional allowance is necessary for stabilizing the conduit in the trench.

Spare Tubes per Route:
"A major advantage of using conduits is the ability to reuse cable spaces without costly excavation by removing smaller, older cables and replacing them with larger cables or fiber facilities. Some companies reserve vacant ducts for maintenance purposes."[33] Version 5.0 of the Hatfield Model provides one spare maintenance duct (as default) in each conduit run. In addition, if there is also a fiber feeder cable along with a copper feeder cable in the run, an additional maintenance duct (as a default) is provided in each conduit run to facilitate a fiber cable replacement at the same time a copper cable replacement may be required.

4.4.19. Pullbox Spacing

Definition: Spacing between pullboxes in the interoffice portion of the network.

Default Value:

Pullbox Spacing
2,000 feet

Support: ***{NOTE: The discussion in Section 3.2.2. [Feeder] is reproduced here for ease of use.}***

Unlike copper manhole spacing, the spacing for fiber pullboxes is based on the practice of coiling spare fiber (slack) within pullboxes to facilitate repair in the event the cable is cut or otherwise impacted. Fiber feeder pullbox spacing is not a function of the cable reel lengths, but rather a function of length of cable placed. The standard practice during the cable placement process is to provide for 5 percent excess cable to facilitate subsurface relocation, lessen potential damage from impact on cable, or provide for ease of cable splicing when cable is cut or damaged.[34] It is common practice for outside plant engineers to require approximately 2 slack boxes per mile.

4.4.20. Pullbox Investment

Definition: Investment per fiber pullbox in the interoffice portion of the network.

Default Value:

Pullbox Investment
$500

Support: ***{NOTE: The discussion in Section 3.7. [Fiber Feeder] is reproduced here for ease of use.}***

[33] Bellcore, *BOC Notes on the LEC Networks - 1994*, p. 12-42.

[34] CommScope, *Cable Construction Manual, 4th Edition*, p. 75.

The information was received verbally from a Vice President of PenCell Corporation at their Supercom '96 booth. He stated a price of approximately $280 for one of their larger boxes, without a large corporate purchase discount. Including installation, HM 5.0 uses a default value of $500.

4.4.21. Pole Spacing, Interoffice

Definition: Spacing between poles supporting aerial interoffice fiber cable.

Default Value:

Pole Spacing, Interoffice
150 feet

Support: This is a representative figure accounting for the mix of density zones applicable to interoffice transmission facilities.

4.4.22. Interoffice Pole Material and Labor

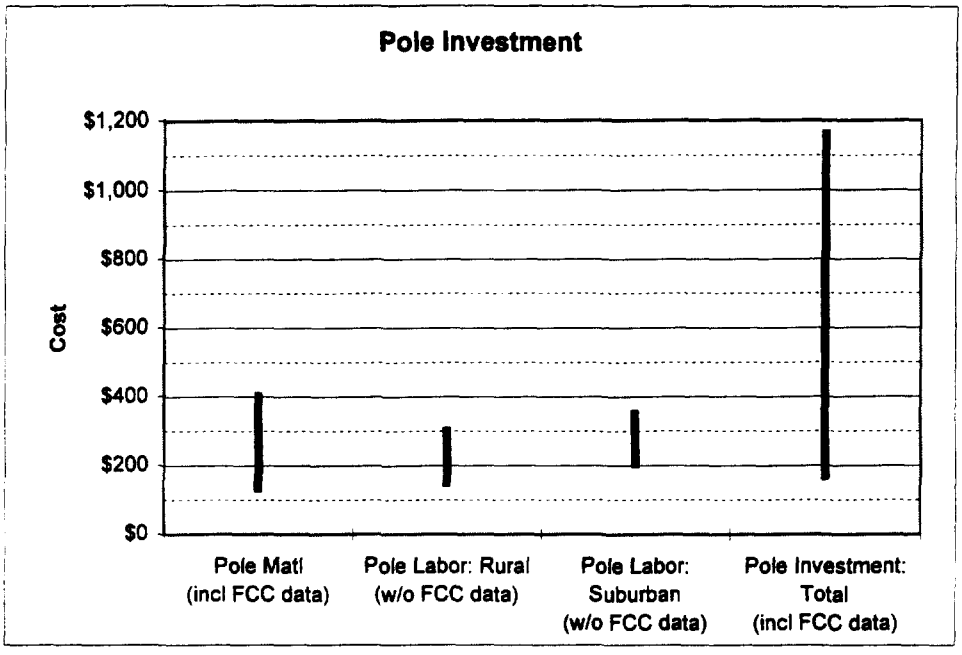
Definition: The installed cost of a 40' Class 4 treated southern pine pole.

Default Values:

Pole Investment	
Materials	$201
Labor	$216
Total	*$417*

Support: ***{NOTE: The discussion in Section 2.4.1. [Distribution] is reproduced here for ease of use.}***

Pole investment is a function of the material and labor costs of placing a pole. Costs include periodic down-guys and anchors. Utility poles can be purchased and installed by employees of ILECs, but are frequently placed by contractors. Several sources revealed the following information on prices.



The exempt material load on direct labor includes ancillary material not considered by FCC Part 32 as a unit of plant. That includes items such as downguys and anchors that are already included in the pole placement labor cost. The steel strand run between poles is likewise an exempt material item, charged to the aerial cable account. The cost of steel strands is not included in the cost of poles; it is included in the installed cost of aerial cable.

4.4.23. Fraction of Interoffice Structure Common with Feeder

Definition: The percentage of structure supporting interoffice transport facilities that is also shared by feeder facilities, expressed as a fraction of the smaller of the feeder and interoffice investment in each of the three types of facilities (i.e., aerial, buried and underground are treated separately).

Default Value:

Fraction of Interoffice Structure Common with Feeder
.75

Support: Interoffice transport facilities will almost always follow feeder routes which radiate from each central office. Typically only a small distance between adjacent wire centers is not traversed by a feeder route; for this distance, structure is appropriately assigned exclusively to interoffice transport. In the opinion of a team of outside plant engineers, the additional structure required exclusively for interoffice transport is no more than 25 percent of the distance. Therefore, 75 percent of the interoffice route is assumed by the HM 5.0 to be shared with feeder cables.

4.4.24. Interoffice Structure Sharing Fraction

Definition: The fraction of investment in interoffice poles and trenching that is assigned to LECs. The remainder is attributed to other utilities/carriers

Default Values:

Fraction of Interoffice Structure Assigned to Telephone		
Aerial	**Buried**	**Underground**
.33	.33	.33

Support: The structure sharing with other utilities covered by this parameter involves the portion of interoffice structure that is not shared with feeder cable. Sharing with other utilities is assumed to include at least two other occupants of the structure. Candidates for sharing include electrical power, CATV, competitive long distance carriers, competitive local access providers, municipal services and others. See also Appendix B.

4.5. TRANSMISSION PARAMETERS

4.5.1. Operator Traffic Fraction

Definition: Fraction of traffic that requires operator assistance. This assistance can be automated or manual (see Operator Intervention Fraction in the Operator Systems section below)

Default Value:

Operator Traffic Fraction
0.02

Support: Industry experience and expertise of HAI.

4.5.2. Total Interoffice Traffic Fraction

Definition: The fraction of all calls that are completed on a switch other than the originating switch, as opposed to calls completed within a single switch.

Default Value:

Total Interoffice Traffic Fraction
0.65

Support: According to *Engineering and Operations in the Bell System*, Table 4-5, p. 125, the most recent information source found to date, the percentage of calls that are interoffice calls ranges from 34 percent for rural areas to 69 percent for urban areas. Assuming weightings according to the typical number of lines per wire center for each environment (urban, suburban, rural), these figures suggest an overall interoffice traffic fraction of approximately 65 percent.

4.5.3. Maximum Trunk Occupancy, CCS

Definition: The maximum utilization of a trunk during the busy hour.

Default Value:

Maximum Trunk Occupancy, CCS
27.5

Support: AT&T Capacity Cost Study.[35]

4.5.4. Trunk Port Investment, per End

Definition: Per trunk equivalent investment in switch trunk port at each end of a trunk.

[35] Blake, et al., *"A Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth"*, p.4.

Default Value:

Trunk Investment, per end
$100

Support: AT&T Capacity Cost Study.[36] HAI judgment is that $100 is for the switch port itself.

4.5.5. Direct-Routed Fraction of Local Interoffice Traffic

Definition: The amount of local interoffice traffic that is directly routed between originating and terminating end offices as opposed to being routed via a tandem switch.

Default Value:

Direct-Routed Fraction of Local Interoffice
0.98

Support: The direct routed fraction of local interoffice is based on data filed by the LECs in response to an FCC data request issued in Docket 80-286: *In the Matter of Amendment of Part 36 of the Commission's Rules and Establishment of a Joint Board*, Docket 80-286, Order, December 1, 1994, 9 FCC Rcd 7962 (1994). See Universal Service Fund Data Request, File 1 of 4, page 8 of 11, 9 FCC Rcd 7962, 7976.

4.5.6. Tandem-Routed Fraction of Total IntraLATA Toll Traffic

Definition: Fraction intraLATA toll calls that are routed through a tandem.

Default Value:

Tandem-Routed Fraction of Total IntraLATA Toll Traffic
0.2

Support: The tandem routed fraction of total intraLATA toll traffic is based on data filed by the LECs in response to an FCC data request issued in Docket 80-286: *In the Matter of Amendment of Part 36 of the Commission's Rules and Establishment of a Joint Board*, Docket 80-286, Order, December 1, 1994, 9 FCC Rcd 7962 (1994). See Universal Service Fund Data Request, File 1 of 4, page 8 of 11, 9 FCC Rcd 7962, 7976.

4.5.7. Tandem-Routed Fraction of Total InterLATA Traffic

Definition: Fraction of interLATA (IXC access) calls that are routed through a tandem instead of directly to the IXC.

[36] Blake, et al., *"A Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth,"*, p. 7.

Default Value:

Tandem-Routed Fraction of Total InterLATA Traffic
0.2

Support: The tandem routed fraction of total interLATA traffic is based on data filed by the LECs in response to an FCC data request issued in Docket 80-286: *In the Matter of Amendment of Part 36 of the Commission's Rules and Establishment of a Joint Board*, Docket 80-286, Order, December 1, 1994, 9 FCC Rcd 7962 (1994). See Universal Service Fund Data Request, File 1 of 4, page 8 of 11, 9 FCC Rcd 7962, 7976.

4.5.8. POPs per Tandem Location

Definition: The number of IXC points of presence requiring an entrance facility, per LEC tandem.

Default Value:

POPs per Tandem Location
5

Support: An assumption that envisions POPs for three principal IXCs plus two smaller carriers associated with each LEC tandem.

4.5.9. Threshold Value for Off-Ring Wire Centers

Definition: The threshold value, in lines, that is used to determine whether a wire center is large enough to be a ring member. Wire centers serving a number of lines greater than or equal to the line threshold will connect to their serving tandem through a ring system; these wire centers are considered to be "on-ring". Wire centers serving less than the threshold number of lines achieve their tandem connectivity through a spur to the tandem itself or to any "on-ring" wire center. This parameter only applies to companies that own and operate a local tandem switch.

Default Value:

Threshold Value for Off-Ring Wire Centers, total lines
5,000

Support: Based on HAI judgment.

4.5.10. Remote-Host Fraction of Interoffice Traffic

Definition: Fraction of local direct traffic assumed to flow from a remote to its host switch.

Default Value:

Remote – Host Fraction of Interoffice Traffic, Remote
0.10

Support: Based on HAI judgment.

4.5.11. Host-Remote Fraction of Interoffice Traffic

Definition: Fraction of local direct traffic assumed to flow from a host to its remotes.

Default Value:

Host – Remote Fraction of Interoffice Traffic, Host
0.05

Support: Based on HAI judgment.

4.5.12. Maximum Nodes per Ring

Definition: Maximum number of ADMs that can form a ring.

Default Value:

Maximum Nodes per Ring
16

Support: Standard configured Bidirectional Switched Line Ring (BSLR) Add Drop Multiplexers (ADMs) support up to 16 nodes in a sing ring.[37]

[37] Fujitsu, *Network Design Features, FJTU-320-560-100, Issue 3, Revision 1*, December 1995, p.11.

4.6. TANDEM SWITCHING

4.6.1. Real Time Limit, BHCA

Definition: The maximum number of BHCA a tandem switch can process.

Default Value:

Real Time Limit, BHCA
750,000

Support: Industry experience and expertise of HAI. These numbers are well within the range of the BHCA limitations NORTEL supplies in its Web site. See 4.1.1.

4.6.2. Port Limit, Trunks

Definition: The maximum number of trunks that can be terminated on a tandem switch.

Default Value:

Port Limit, Trunks
100,000

Support: AT&T Updated Capacity Cost Study.[38]

4.6.3. Tandem Common Equipment Investment

Definition: The amount of investment in common equipment for a large tandem switch. Common Equipment is the hardware and software that is present in the tandem in addition to the trunk terminations themselves. The cost of a tandem is estimated by the HM as the cost of common equipment plus an investment per trunk terminated on the tandem.

Default Value:

Tandem Common Equipment Investment
$1,000,000

Support: AT&T Capacity Cost Study.[39]

4.6.4. Maximum Trunk Fill (Port Occupancy)

Definition: The fraction of the maximum number of trunk ports on a tandem switch that can be utilized.

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[38] Brand, T.L., Hallas, G.A., et al., *"An Updated Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth"*, April 19, 1995, p. 9.

[39] Blake, et. al., *"A Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth"*, p.9.

Default Value:

Maximum Trunk Fill (port occupancy)
0.90

Support: This is a HAI estimate, which is used in lieu of forward looking alternatives from public sources or ILECs. It is based on consultations with AT&T and MCI subject matter experts.

4.6.5. Maximum Tandem Real Time Occupancy

Definition: The fraction of the total capacity (expresses as the real time limit, BHCA) a tandem switch is allowed to carry before an additional switch is provided.

Default Value:

Maximum Tandem Real Time Occupancy
0.9

Support: Bell Communications Research, *LATA Switching Systems Generic Requirements*, Section 17: Traffic Capacity and Environment, TR-TSY-000517, Issue 3, March 1989, figure 17.5-1, p. 17-24.

4.6.6. Tandem Common Equipment Intercept Factor

Definition: The multiplier of the common equipment investment input that gives the common equipment cost for the smallest tandem switch, allowing scaling of tandem switching investment according to trunk requirements.

Default Value:

Tandem Common Equipment Intercept Factor
0.50

Support: Value selected to allow tandem common equipment investment to range from $500,000 to $1,000,000 which is the appropriate range based on expertise of HAI.

4.6.7. Entrance Facility Distance from Serving Wire Center & IXC POP

Definition: Average length of trunks connecting an IXC POP with the wire center that serves it.

Default Value:

Entrance Facility Distance from Serving Wire Center & IXC POP
0.5 miles

Support: Value selected in recognition of the fact that IXCs typically locate POPs close to the serving wire center to avoid long cable runs.

4.7. SIGNALING

4.7.1. STP Link Capacity

Definition: The maximum number of signaling links that can be terminated on a given STP pair.

Default Value:

STP Link Capacity
720

Support: AT&T Updated Capacity Cost Study.[40]

4.7.2. STP Maximum Fill

Definition: The fraction of maximum links (as stated by the STP link capacity input) that the model assumes can be utilized before it adds another STP pair.

Default Value:

STP Maximum Fill
0.80

Support: The STP maximum fill factor is based on HAI engineering judgment and is consistent with maximum link/port fill levels throughout HM 5.0.

4.7.3. STP Maximum Common Equipment Investment, per Pair

Definition: The cost to purchase and install a pair of maximum-sized STPs.

Default Value:

STP Maximum Common Equipment Investment, per pair
$5,000,000

Support: AT&T Updated Capacity Cost Study.[41]

4.7.4. STP Minimum Common Equipment Investment, per Pair

Definition: The minimum investment for a minimum-capacity STP, i.e.: the fixed investment for an STP pair that serves a minimum number of links.

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[40] Brand, et al., *"An Updated Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth"*, p. 26.

[41] Brand, et al., *"An Updated Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth"*, p. 26.

Default Value:

STP Minimum Common Equipment Investment, per pair
$1,000,000

Support: It is necessary to allow the scaling of STP common equipment for smaller STPs that in some configuration are sufficient for local exchange carriers. The minimum STP common equipment investment cost is an HAI judgment of the lower end of the range of common equipment investment.

4.7.5. Link Termination, Both Ends

Definition: The investment required for the transmission equipment that terminates both ends of an SS7 signaling link.

Default Value:

Link Termination, Both Ends
$900

Support: AT&T Updated Capacity Cost Study.[42]

4.7.6. Signaling Link Bit Rate

Definition: The rate at which bits are transmitted over an SS7 signaling link.

Default Value:

Signaling Link Bit Rate
56,000 bits per second

Support: The AT&T Updated Capacity Cost Study, and an SS7 network industry standard.[43]

4.7.7. Link Occupancy

Definition: The fraction of the maximum bit rate that can be sustained on an SS7 signaling link.

Default Value:

Link Occupancy
0.40

[42] Brand, et al., *"An Updated Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth"*, p. 26.

[43] Brand, et al., *"An Updated Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth"*, p. 25.

Support: AT&T Updated Capacity Cost Study.[44]

4.7.8. C Link Cross-Section

Definition: The number of C-links in each segment connecting a mated STP pair.

Default Value:

C Link Cross-Section
24

Support: The input was derived assuming the 56 kbps signaling links between STPs are normally transported in a DS-1 signal, whose capacity is 24 DS-0s.

4.7.9. ISUP Messages per Interoffice BHCA

Definition: The number of Integrated Services Digital Network User Part (ISUP) messages associated with each interoffice telephone call attempt. Switches send to each other ISUP messages over the SS7 network to negotiate the establishment of a telephone connection.

Default Value:

ISUP messages per interoffice BHCA
6

Support: AT&T Updated Capacity Cost Study.[45]

4.7.10. ISUP Message Length, Bytes

Definition: The average number of bytes in each ISUP (ISDN User Part) message.

Default Value:

ISUP Message Length
25 bytes

Support: Bellcore Technical Reference TR-NWT-000317, Appendix A, shows that 25 bytes per message is a conservatively high figure. Northern Telecom's DMS-STP product/service information booklet shows an average ISUP message length of 25 bytes.[46] Therefore a default value of 25 average bytes per message is appropriate for use in the Hatfield Model.

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[44] Brand, et al., *"An Updated Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth"*, p. 24.

[45] Brand, at al., *"An Updated Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth"*, p. 25.

[46] Northern Telecom, *DMS-STP Planner 1995, Product/Service Information, 57005.16, Issue 1*, April, 1995, p.13.